I CLAIM:

1. A method for shading polygon surfaces in a rendering system comprising the steps of:

providing a polygon within the scene database to be shaded a polygon coordinate system defined by three normalized vectors which represent the X, Y and Z axes;

providing a light source defining a three-dimensional light source direction vector;

rotating the three-dimensional light source direction vector to correspond with the polygon coordinate system in order to provide a rotated three-dimensional light source direction vector; and

converting the rotated three-dimensional light source direction vector into a two-dimensional vector whose length is proportional to the angle between the polygon Z vector and the three-dimensional light source direction vector.

2. The method for shading polygons of claim 1 further comprising the steps of:

providing a three-dimensional light specularity vector;

rotating the three-dimensional light specularity vector to correspond with the polygon coordinate system; and

converting the rotated three-dimensional light specularity vector into a two-dimensional vector whose length is proportional to the angle between the polygon Z vector and the three-dimensional light specularity vector.

3. The method for shading polygons of claims 1 or 2, wherein the step of converting the rotated three-dimensional light source direction vector into a two-dimensional vector comprises the steps of:

determining a value of proportionality from the component values of the light source direction vector;

dropping, from the three-dimensional light source direction vector, the vector component corresponding to a Z-coordinate and leaving the two remaining components; and

scaling the remaining components by the value of proportionality in order to create the two-dimensional vector whose length is proportional tot he angle between the polygon Z vector and the light source direction vector.

4. The method for shading polygons of claim 3, wherein the step of determining a value of proportionality is determined by:

$$r = \frac{2\cos^{-1} C}{\pi \sqrt{1-C^2}}$$

where r is said value of proportionality and C is the Z component of the three-dimensional light source direction vector.

5. The method of shading polygons according to claim 3 wherein the step of determining a value of proportionality includes the step of providing a lookup table which is indexed by one or more component values of said three-dimensional light source direction vector.

6. A method for determining lighting coefficients for a pixel residing on a polygon surface within a polygon graphics system comprising the steps of:

providing a two-dimensional vertex angle vector for each of the polygon's vertices;

providing a two-dimensional light source direction vector;

interpolating the vertex angle vectors for each drawn pixel on the polygon surface;

combining the interpolated vertex angle vector with a two-dimensional bump map vector to produce a composite surface angle vector; and

obtaining a diffuse light coefficient value from a function of the distance between the composite surface angle vector and the two-dimensional light source direction vector.

7. The method for determining pixel lighting coefficients of claim 6 further comprising the steps of:

providing a two-dimensional light specularity vector;

obtaining a specular light coefficient value from a function of the distance between the composite surface angle vector and the two-dimensional light specularity vector.

8. The method for determining pixel lighting coefficients of claim 7 wherein the step of obtaining a diffuse light coefficient value from a function of the distance between the composite surface angle vector and the two-dimensional light source direction vector includes the step of providing a lookup table for the determination of the distance function.

9. The method for determining pixel lighting coefficients of claim 8 wherein the step of obtaining a specular light coefficient value from a function of the distance between the composite surface angle vector and the two-dimensional light specularity vector includes the step of providing a lookup table for the determination of the distance function.

10. A system for shading polygon surfaces in a rendering system, the system comprising a computer having:

a database having a first set of data representing the orientation of the polygon and a second set of data representing a three-dimensional light source direction vector;

a processor operatively connected to receive the first and second sets of data and including a logic element capable of a) generating a rotated three-dimensional light source direction vector corresponding with a polygon

coordinate system of the polygon and b) converting the rotated three-dimensional light source direction vector into a two-dimensional vector representative of the three-dimensional light source direction vector; and

a display operatively connected to the processor.

11. The system of claim 10 wherein the database includes a third set of data corresponding to a three-dimensional light specularity vector and the logic element of the processor having a logic element capable of a) generating a rotated three-dimensional light specularity vector and b) converting the rotated three-dimensional light specularity vector into a two-dimensional vector representative of the three-dimensional light specularity vector.

12. The system of claim 11 wherein the logic element of the processor is further capable of generating a variable scaler quantity r useful in generating the two-dimensional vectors.

13. The system of claim 11 wherein the database includes a fourth set of data further comprising a variable scaler quantity r useful in generating the two-dimensional vectors.

14. An system for determining lighting coefficients for a pixel residing on a polygon surface within a polygon graphics system, the system having a computer comprising:

a database having a first set of data representing a bump map for the polygon and second set of data corresponding to a plurality of surface angle vectors representing the orientation of the polygon;

a processor operatively connected to receive the first and second sets of data and including a logic element capable of a) interpolating the surface angle vectors, b) combining an interpolated surface angle vector with a two-dimensional bump map vector for the database to produce a composite surface angle vector, and c) determining a diffuse light coefficient value from a function

of the distance between the composite surface angle vector and a two-dimensional light source direction vector stored in the database; and

a display operatively connected to the processor.

15. The system of claim 14 wherein the logic element of the processor is further capable of or obtaining a specular light coefficient value from a function of the distance between the composite surface angle vector and a two-dimensional light specularity vector stored in the database.

16. The system of claim 15 wherein the database includes data useful in the determination of the distance function for the two-dimensional light source direction vector.

17. The system of claim 16 wherein the database includes data useful in the determination of the distance function for a two-dimensional light specularity vector.

18. A method for lighting surfaces in a rendering system comprising the steps of:

providing a scene database including a polygon having a polygon surface represented by three-dimensional vectors;

providing a light source defining a three-dimensional light source direction vector;

providing a bump map;

rotating the light source direction vector to a (3D) polygon orientation at each vertex;

interpolating the rotated light source direction vector at each vertex;

calculating, using dedicated pixel shading computer hardware, a lighting equation to provide a shading value for substantially each drawn pixel residing on the polygon surface using the bump map and the interpolated light source direction vector, the dedicated computer hardware configured to produce a shading value using linear calculations and only mathematical functions selected from the group of addition, subtraction, multiplication and division whereby a display signal incorporating the shading values is generated without using a square root calculation.

19. The method of claim 18 wherein the light source is point light source.

20. The method of claim 19 wherein the step of interpolating includes interpolating a surface normal vector.

21. The method of claim 20 wherein the step of calculating a lighting equation includes the use of a reference map which includes information useful in the determination of a shading value.

22. The method of claim 21 wherein the step of calculating a lighting equation includes calculating a surface normal vector per pixel.

23. The method of claim 22 wherein the surface normal vector is calculated using the bump map.

24. The method of claim 23 wherein the bump map is contained at least partially in local texture memory.

25. The method of claim 24 wherein a bump map vector is calculated for substantially each pixel.

26. The method of claim 25 wherein the bump map vector is combined with the surface normal vector.

27. A system for lighting surfaces in a rendering system comprising:

a scene database including polygon information corresponding to a polygon with the polygon surface represented by three-dimensional vectors and light source information including a three-dimensional (3-D) light source direction vector;

a bump map;

a graphics processing unit including logic that rotates the light source direction vector to a (3-D) polygon orientation at each vertex and interpolates the rotated light source direction vector at each vertex, the graphics processing unit having dedicated pixel shading computer hardware to calculate a lighting equation to provide a shading value for substantially each drawn pixel residing on the polygon surface using the bump map and the interpolated light source direction vector, the dedicated computer hardware configured to produce a shading value using linear calculations and only mathematical functions selected from the group of addition, subtraction, multiplication and division whereby a display signal incorporating the shading values is generated without using a square root calculation.

28. The system of claim 27 wherein the light source is a point light source.

29. The system of claim 28 wherein the processing unit includes hardware logic that interpolates a surface normal vector.

30. The system of claim 29 wherein the processing unit includes hardware logic operable to calculate a surface normal vector per pixel.

31. The system of claim 30 wherein the processing unit includes hardware logic operable to receive information from the bump map to calculate the surface normal vector.

32. The system of claim 31 wherein the bump map is contained at least partially in a local texture memory.

33. The system of claim 32 wherein the processing unit includes hardware logic operable to calculate a bump map vector for substantially each pixel.

34. The system of claim 33 wherein the process includes hardware logic operable to combine the bump map vector with the surface normal vector.